

Quaternary Times



Newsletter

June 2017

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The American Quaternary Association Newsletter

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...devoted to studying all aspects of the Quaternary Period since 1970

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Cover: Mendenhall Glacier near Juneau, Alaska. Photo taken by Thomas Monecke in Summer 2011.

The View from the Moraine: the President's Message

By Sheri Fritz, University of Nebraska – Lincoln

Energized by the very successful biennial meeting in Santa Fe last summer, AMQUA has already started planning for the next meeting, and we are excited to announce that it



will be a joint meeting of **AMQUA and CANQUA**. In an era when scientific endeavors increasingly involve international and interdisciplinary teams, we thought it would be appropriate to partner with our American neighbors to discuss long-standing questions and new frontiers in Quaternary sciences. The meeting is scheduled for **August 7-11, 2018 in Ottawa** at the University of Ottawa. Ottawa is a beautiful city, and the University of Ottawa can easily accommodate the combined group, including a variety of lodging options on campus and nearby, easy access to a range of restaurants, and an excellent public transportation system - so this should be a great venue for interacting and sharing ideas. The program committee has scheduled its first meeting for the end of April, and Tom Lowell and Kendra McLaughlin will represent AMQUA in developing a theme and the associated program – please contact them with any ideas you have. We recognize that historically the two groups have had somewhat different meeting structures, so the intention is to combine some of the features of each group for this meeting, including extended poster sessions, an emphasis on plenary speakers, and a meeting theme from the usual AMQUA template coupled with a mid-meeting fieldtrip and larger roster of submitted presentations from the CANQUA side. There also are already ideas for some great post-meeting fieldtrips. So, look

forward to more news as things evolve and please save the dates!

Things also have been in motion with the January 2017 transition of *Quaternary Research* (QR) to its new home with Cambridge University Press - see the article by the QR editors in this issue of the newsletter for additional information.

In the transition, there was some confusion for the small number of AMQUA members that historically have maintained QR print subscriptions at a reduced rate; given the proliferation of online access, the extremely small number of people that used this benefit, and the high cost of the subsidy, it has been discontinued. None-the-less we have been discussing a tighter relationship between the Quaternary Research Center, QR's parent organization, and AMQUA, including the possibility of some sort of reduced online subscription rates for AMQUA members. So, we'll update you as we move forward on this issue. Meanwhile check out QR's new website and current content and continue to support QR by submitting high-quality articles for review.

AMQUA is a small friendly organization dedicated to serving the Quaternary community, so please don't hesitate to contact us with ideas about new ways we can most effectively meet our mission. Clearly these are uneasy and challenging times for science and scientists. So, I urge you to maintain and support your network of colleagues, to stay engaged, and to be active and creative in meeting the evolving challenges.



Neotoma Paleocology Database – Recent Updates, Call for Data Stewards

By John Williams, University of Wisconsin-Madison
 Eric Grimm, University of Minnesota
 Jessica Blois, University of California, Merced
 Simon Goring, University of Wisconsin-Madison
 Alison Smith, Kent State University
 Neotoma Leadership Council

The Neotoma Paleocology Database, which serves as a community-curated data repository for Quaternary and Pliocene paleoecological and paleoenvironmental data, continues to grow and develop, with support from NSF Geoinformatics and EarthCube (<http://earthcube.org>). Here we summarize recent activities and highlight opportunities for our community to contribute data and make use of Neotoma's capabilities.

Data Holdings. Neotoma now holds over 3.5 million individual observations of taxa and other paleo proxies from over 16,000 datasets and 8,600 sites (Figure 1). Paleocological dataset types in Neotoma include pollen (5,100 datasets), vertebrates (3,500), diatoms (852), ostracodes (543), macroinvertebrates (383), plant macrofossils (245), insects (150), testate amoebae (82), and phytoliths (1!). Data uploads have accelerated since 2014, when the new Neotoma data model, which facilitated input of data across proxy types, was finalized and new data began to be uploaded. Neotoma also holds over 3,500 geochronologic datasets and 16,832 individual age controls.

Putting Data In. Data inputs into Neotoma are handled by Data Stewards to ensure high-quality data curation, with a series of automated quality-check tools available to Stewards. We are actively recruiting Data Stewards and train new Stewards by in-person workshops (e.g., AMQUA 2016, 2018) or webinars. If you have data that you'd like to add, we can either help upload data or provide Data Steward training.

Getting Data Out. Researchers and educators wishing to use Neotoma data have several good options.

Neotoma Explorer (<https://apps.neotomadb.org/explorer/>) offers a map-based interactive interface that is a good option for first-pass exploration and data viewing. Neotoma's application programming interfaces (APIs, <https://api.neotomadb.org>) support queries from your browser or other programming languages (e.g., <http://api.neotomadb.org/v1/data/sites?sitename=%2Alake%2A> will search for all sites with 'lake' in their name). Data can also be directly imported into R using the *neotoma* program (Goring et al., 2015). The widely used Tilia program can directly download Neotoma data into Tilia using a map-based interface. Neotoma data can also be found through the NOAA Paleoclimatology portal and the Global Pollen Project. A new visualization service, called Ice Age Mapper, is in the works, stay tuned!

New Developments. The Neotoma data model was recently extended to hold stable isotopic measurements of fossil specimens ($\delta^{18}\text{O}$, $\delta^{13}\text{C}$, $\delta^{15}\text{N}$, δD , $\delta^{34}\text{S}$, and $^{87}\text{Sr}/^{86}\text{Sr}$) and sediment samples. We are in the process of minting data object identifiers (DOIs) for all Neotoma datasets, to support journal data publishing requirements. Going forward, DOIs will be automatically assigned to new datasets uploaded to Neotoma. Neotoma Explorer's Stratigraphic Diagrammer has been extended to show ostracode and diatom data and soon will be extended to vertebrates and plant macrofossils.

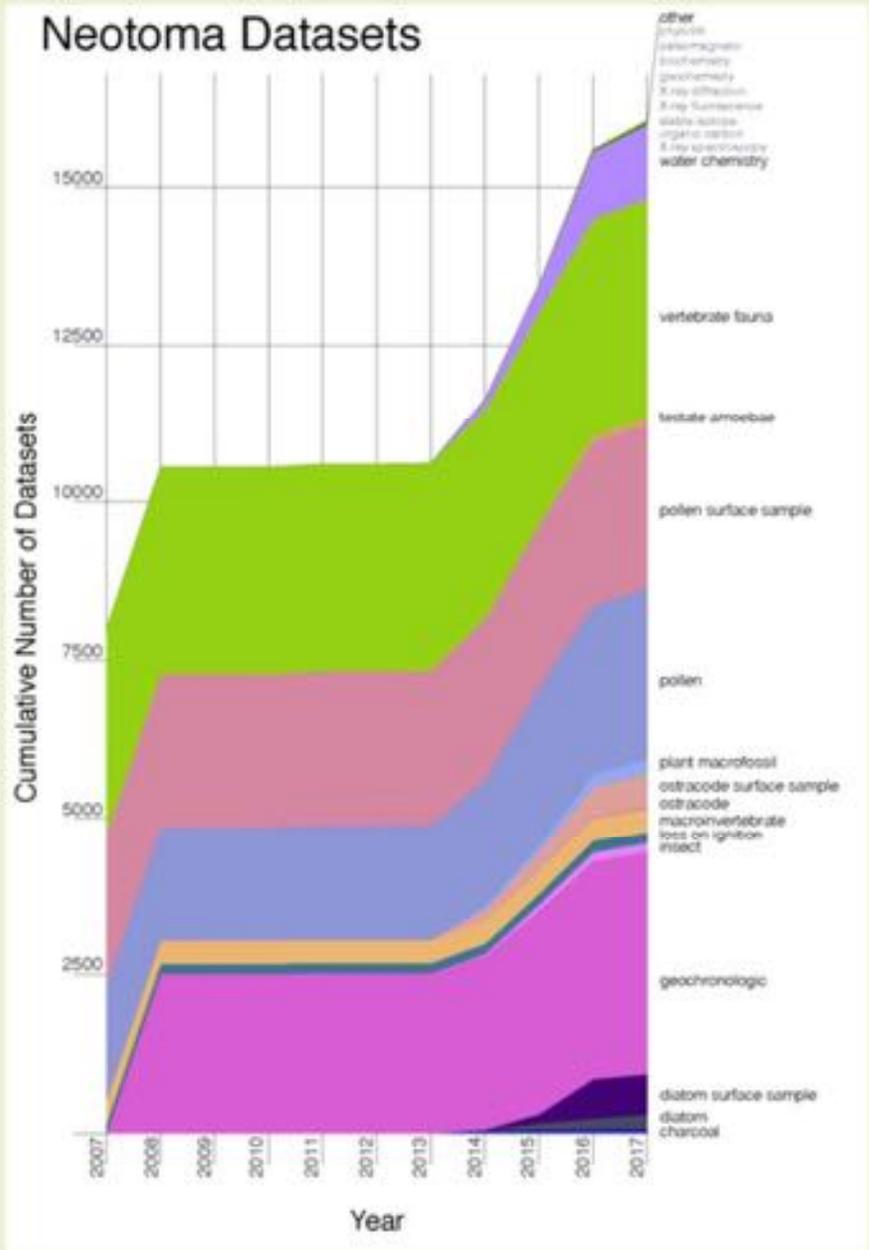


Figure 1: Data uploads to the Neotoma Paleocology Database, expressed as number of datasets per year. Datasets are defined as all samples of a given type from a given sampling location, e.g., all pollen samples from a single lake sediment core would compose one dataset. Observations are calculated by multiplying the number of samples in a dataset by the number of variables measured in that dataset, then summing across all datasets. Figure design by Scott Farley.

Governance. The Neotoma community recently approved by-laws (<http://www.neotomadb.org/about/category/governance>) and is governed by a Leadership Council (Table 1), which was elected in early 2017. The Leadership Council is intended to represent the diversity of proxy types, scientists, and regions in our community.

Want to Help? Neotoma is a community resource and we seek to advance the Quaternary sciences more generally. You can help! Ways you can help

include using Neotoma, letting us know how it can be improved, contributing your data, serving on the Leadership Council (elections annually) and becoming a Data Steward. Of these, the critical need is to further crowdsource the preparation and upload of data into Neotoma. If you'd like to learn how to become a Data Steward, contact one of us – we'll show you how to get started.

Table 1: Neotoma Leadership Council and PIs. WG = Working Group.

Name	Role(s)
Mike Anderson	PI
Allan Ashworth	PI, Leadership Council, Chair International Partnerships WG
Julio Betancourt	PI
Phil Buckland	Leadership Council
Jessica Blois	PI, Leadership Council, Asst. Chair Executive WG
Bob Booth	PI
Don Charles	PI, Leadership Council
Brandon Curry	PI
Ed Davis	PI
Thomas Giesecke	Leadership Council, International Partnerships WG
Simon Goring	PI, Leadership Council, Chair IT/Dev WG
Russ Graham	PI, Chair Education & Outreach WG
Eric Grimm	PI, Leadership Council, Executive WG
Sonja Hausmann	PI
Claudio Latorre	Leadership Council, International Partnerships WG
Timshel Purdum	PI, Leadership Council
Rob Roth	PI
Alison Smith	PI, Leadership Council, Executive WG
Hikaru Takahara	Leadership Council, International Partnerships WG
Jack Williams	PI, Leadership Council, Chair Executive WG

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Goring, S., Dawson, A., Simpson, G., Ram, K., Graham, R.W., Grimm, E.C., Williams, J.W. (2015) *neotoma*: A Programmatic Interface to the Neotoma Paleoecological Database. *Open Quaternary* 1, 1–17.

The Tell-Tale Tusk

By Joanne P. Ballard, Knoxville, TN

Andre Bijkerk, Independent Researcher, The Netherlands

Dick Mol, Natuurhistorisch Museum, Rotterdam, The Netherlands

Jelle Reumer, Natuurhistorisch Museum, Rotterdam, The Netherlands

Corresponding author: Joanne P. Ballard, joannepballard@gmail.com



The Tell-Tale Tusk is a very special tusk from a female woolly mammoth (*Mammuthus primigenius*) from Siberia. Dick Mol, a Dutch paleontologist, showed it to me (J. Ballard) in 2004. The part of the tusk that had been up in the socket is pristine, but the ivory is deeply etched where the tusk exited the socket. A living elephant would have a skin flap here. The portion of the tusk that would have been exposed to the atmosphere is highly polished. The damage occurred while the animal was alive, evidenced by this polishing of the ivory surface. My PhD research on nitrogen isotopes triggered my idea for what happened to the Tell-Tale Tusk. I was studying lake sediment cores and seeing some perturbations in the $\delta^{15}\text{N}$ and total nitrogen data around late-glacial time. I searched the literature, and found that nitric acid rain forms as a result of an impact by a bolide. Prinn and Fegley (1987) reported that the asteroid impact associated with the K/T extinction of the dinosaurs 66 Ma triggered a shock wave to the atmosphere, which dissociated the atmospheric nitrogen and damaged the ozone layer. This resulted in the formation of nitrates, which then rained out of the atmosphere as nitric acid rain for some months. Firestone et al. (2007) proposed that an extraterrestrial impact occurred around 13,000 years ago, which destroyed the Laurentide ice sheet, caused massive wildfires, and killed off the megafauna. If this were the case, nitric acid rain would surely have followed the impact event.

Vast herds of woolly mammoths once roamed the steppe environments in North America and Eurasia. If Firestone et al. (2007) are correct about the bolide strike, any animals that survived the initial catastrophe would have been subjected to acid precipitation

over a period of months. Their thick coats would have protected their skin, but may have become bleached. However, the exposed surfaces of their tusks would have been softened, and as they moved about, bumping their tusks against things in their environment, the ivory would have become polished (Fig. 1). Our acid experiments on cubes of ivory showed that the acid rain would likely have been pH2 (Fig. 2), like lemon juice. Mammoths, like elephants, would have consumed up to 500 lbs of fodder a day, and as the animal stuffed acid-soaked fodder into its mouth, that acid fluid would get under the skin flap at the tusk socket and pit the ivory (Fig. 1). This part of the tusk could not become polished, as it would have been protected from mechanical abrasion. This is the pattern we observe.

The evidence for nitric acid rain could be found in lake sediment cores as perturbations of the $\delta^{15}\text{N}$ together with an increase in total nitrogen. I see such evidence in my late-glacial data for sites in eastern North America. Kolesnikov et al. (1998) also found such a signal in peat cores from the Tunguska impact site in Siberia, which occurred in 1908. Massive algal and diatom blooms would also be evident in the sedimentary record. Many paleoenvironments papers report massive algal blooms at the onset of the Younger Dryas (~12,800 years ago); pollen records for this time indicate an open landscape (heliophytic herbaceous flora).

If a catastrophic wildfire is followed by nitric acid rain for several months, re-population of trees and shrubs would be suppressed.

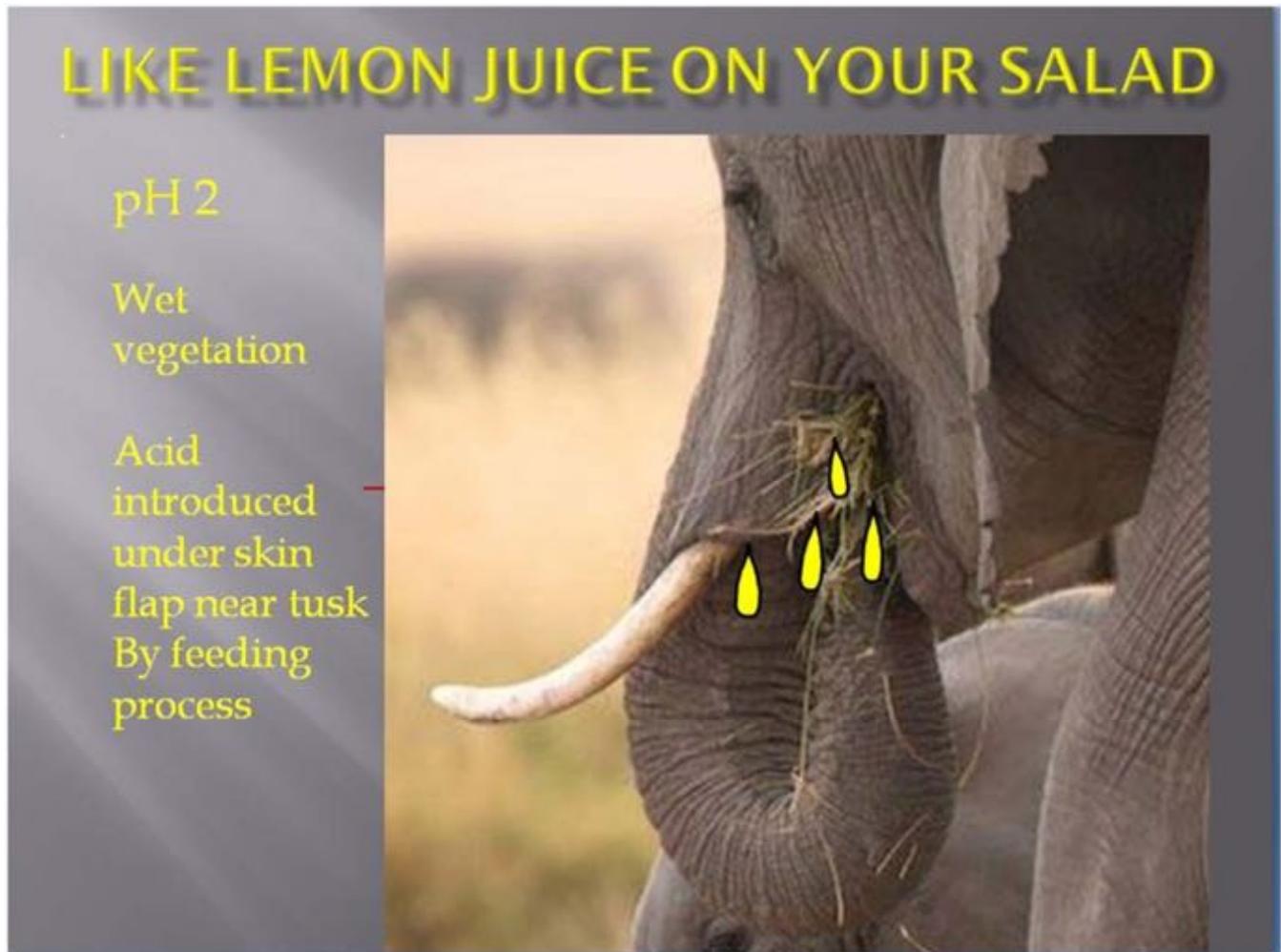


Figure 2: Acid introduction under skin.

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- Firestone, R.B., West, A., Kennett, J.P., Becker, L., Bunch, T.E., Revay, Z.S., Schultz, P.H., Belgia, T., Kennett, D.J., Erlandson, J.M., Dickenson, O.J., Goodyear, A.C., Harris, R.S., Howard, G.A., Kloosterman, J.B., Lechler, P., Mayewski, P.A., Montgomery, J., Poreda, R., Darrah, T., Hee, S.S., Smith, A.R., Stich, A., Topping, W., Wittke, J.H., Wolbach, W.S. (2007) Evidence for an extraterrestrial impact 12,900 years ago that contributed to the mega-faunal extinctions and the Younger Dryas cooling. *Proceedings of the National Academy of Sciences of the United States of America* 104, 16016–16021.
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- Prinn, R.G., Fegley, B., Jr. (1987) Bolide impacts, acid rain, and biospheric traumas at the Cretaceous-Tertiary boundary. *Earth and Planetary Science Letters* 83, 1–15.

Ongoing Research Projects

Analyzing South American tropical lakes across space and time

By Xavier Benito and Melina Feitl, The Fritz Lab, Department of Earth and Atmospheric Sciences, University of Nebraska-Lincoln

The tropical Andes and Amazonian lowlands are considered a mega-diverse region, with high levels of provincialism and endemism of both macro (e.g., vegetation) and micro-organisms, as well as latitudinal diversity gradients. The species composition and diversity of diatoms (unicellular siliceous algae) are influenced by environmental change and evolutionary processes in a variety of direct and indirect ways. In tropical South America the wide latitudinal, longitudinal, and elevational ranges, coupled with diverse physiographic regions and geologic substrates produce notable climatic and limnological variability that can be used to examine the factors that structure the species composition and diversity of diatom assemblages. In addition, lacustrine archives of systems of varied origins and ages enable fossil diatoms to be used to track recent (10s-100s yr) and historic (1000s yr) ecological and climatic history.

Given the potential of the tropical lakes as sentinel ecosystems sensitive to environmental and climatic impacts, our group is conducting a multifaceted research approach that encompasses biogeography, limnology, and paleoecology. First, biogeographic principles and metacommunity ecology are being used to disentangle the relative effects of local (environment) and regional (geographic and climatic) factors that shape modern diatom assemblages across the tropical Andes and adjacent Amazon lowlands. We have evaluated broad-scale diatom distribution in about 200 lakes throughout the region (0–28°S and 58–80°W), primarily derived from samples from Bolivia, Perú, and Ecuador collected over the years by the Fritz lab, Dr. Pedro Tapia, Dr. Miriam Steinitz-Kannan, and other collaborators. Our results (Benito et al., in review) show distinctive regional diatom floras along a latitudinal gradient and indi-



cate that a combination of limnological and geoclimatic predictors best describe the spatial ecology of diatoms. These results suggest that diatoms are under micro-evolutionary constraints.

Meanwhile, we are expanding the South American diatom database by incorporating lake samples from Colombia, Brazil, and Argentina thanks to our collaborators Dr. Maria I. Velez (University of Regina, Canada), Dr. Luciana Gomez Barbosa (Federal University of Paraíba, Brazil), and Dr. Michael McGlue (University of Kentucky, USA), respectively.

As a complementary study, the spatial extent of recent limnological change is being evaluated as a baseline for paleolimnological reconstructions in Ecuador. Together with our collaborator Prof. Miriam Steinitz-Kannan from the University of San Francisco in Quito (Ecuador), who extensively sampled diatoms and water chemistry in the 1970s and early 1980s from a range of lakes in different ecoregions of Ecuador, we will be able to assess the magnitude of floristic change within these lakes over the last 40 years and test which environmental (e.g., lake chemistry, elevation, water depth) or geographic (climate, connectivity, lake size) factors are the most important drivers (or not) of the observed floristic changes.



Figure 1: Páramo Andean lakes of Ecuador. Mojanda lakes (Caricocha, Huarmicocha and Yanacocha) in Imbabura province, northern Ecuador. Photo by X. Benito.



Figure 2: Chiriacu lake in Imbabura province. Photo by X. Benito.

Many of these lakes are closed-basin and are susceptible to changes in the precipitation-evaporation balance (Figs. 1,2).

A paired regional time-series analysis of hydroclimatic variables (rainfall, humidity, cloud cover, etc.) from 1970 to present day will aid interpretations of spatial variability and driving mechanisms for within-lake changes.

As a final approach, long cores from four Interandean and Páramo lakes in Ecuador will be collected

during a July 2017 field season with the help of our colleagues Professor Paul Baker (Yachay Tech University, Urcuquí) and Dr. Luis Quevedo (Escuela Politécnica Superior del Chimborazo). Paleolimnological reconstruction using diatom assemblage shifts and complementary proxies will be used to assess Holocene limnological variability. These reconstructions can be used for comparison with other Holocene lacustrine sediment records to create a comprehensive picture of temporal variability in Southern Hemisphere tropical high-mountain regions.

The Hydrothermal Dynamics of Yellowstone Lake

By Sabrina R. Brown, The Fritz Lab, Department of Earth and Atmospheric Sciences, University of Nebraska-Lincoln

Continental hydrothermal systems are of scientific significance to understanding Earth processes and are excellent analogs for early and extraterrestrial life. Yellowstone National Park is the largest concentration of terrestrial hydrothermal features on Earth, with over 10,000 hydrothermal structures.





Figure 1: Sediment coring rig anchored on Yellowstone Lake (September 2016).

Yellowstone Lake is a key hydrothermal basin in Yellowstone, with hundreds of active and inactive vents and seeps. The “Hydrothermal Dynamics of Yellowstone LAKE” (HD-YLAKE) project is focused on quantifying the effects of climate, volcanic processes, and earthquakes on Yellowstone Lake’s hydrothermal system. The HD-YLAKE team includes scientists from more than ten institutions and represents a variety of disciplines.

Six multi-meter sediment cores were collected from Yellowstone Lake in September 2016 (Figure 1). Paleoenvironmental reconstructions from two of the cores will be conducted by Sabrina Brown with Sheri Fritz (University of Nebraska-Lincoln) and Chris Schiller with Cathy Whitlock (Montana State University). Sabrina’s research focuses on utilizing fossilized diatoms, a microscopic siliceous algae, to reconstruct past climate and assess the impact of hydrothermal activity on the aquatic ecosystem. Diatoms can be used to reconstruct past environmental conditions because community composition is driven by nutrient loading and light availability, which

are controlled by local weather and the result of regional climate.

The diatom assemblage of a 12-meter core collected distally from hydrothermal activity is being assessed to reconstruct Holocene paleoclimate. Sabrina and Chris are working in tandem on an 11-meter sediment core from Yellowstone Lake to assess the effects of significant hydrothermal activity on limnological (diatom) and terrestrial (pollen and charcoal) systems. The effects of hydrothermal activity recorded in some smaller lakes within the Yellowstone caldera will also be determined. Sabrina is also assisting with determining the history of hydrothermal structures (including vents and siliceous spires) through quantifying the presence and species composition of diatoms preserved within. Pat Shanks and Lisa Morgan (both USGS emeritus) are utilizing the sediment cores to assess the geochemistry, geology, and physical processes of the hydrothermal system of Yellowstone Lake.

The HD-YLAKE project also includes long-term monitoring of a set of hydrothermal vents with a suite of geophysical and geochemical instrumentation, which will provide detailed data for the modern system. Further, this project has incited complementary research efforts within Yellowstone Lake including evaluating silica cycling (Petra Zahajská at Lund University), reconstructing Holocene paleohydrology with isotopic tracers (Rosine Cartier at Lund University), and assessing the population genetics of the endemic evolution of the diatom species *Stephanodiscus yellowstonensis* from *Stephanodiscus niagarae* (Trisha Spanbauer at University of Texas at Austin).

For more information and updates on the HD-YLAKE project, including a complete list of researchers, please visit <http://hdylake.org/>. For research blogs from Sabrina visit <https://sites.google.com/site/sabrinareneebrown/>

Paleohydrology of Desert Wetlands

By Jeff Honke, USGS, Denver, CO

Scientists from the USGS are reconstructing how hydrologic conditions varied through the Holocene using the physical and chemical properties of sedi-



Figure 1: Coring near Saratoga Springs, Death Valley National Park, CA.

ments recovered near Saratoga Springs, located in the southern part of Death Valley National Park, California (Fig. 1). The efforts are a part of the “Paleohydrology of Desert Wetlands” project of the Geosciences and Environmental Change Science Center. The group is focused on extracting details of landscape evolution in the deserts of the American Southwest, using extant springs as a potential source for rare hydrographic information. Similar work has been conducted at active springs located along the western edge of Soda Lake, near Zzyzx, CA.

For more information, go to the project page at the following site. <https://esp.cr.usgs.gov/projects/paleowetlands/index.shtml>

Recent Graduates

Harold Wershow (2016) A Holocene Glaciolacustrine record of the Lyman Glacier and implications for glacier fluctuations in the North Cascades, Washington. Master's thesis, Western Washington University, Bellingham, Washington. Advisor: Douglas H. Clark

Recent Publications

Madole, R.F., VanSistine, D.P., Romig, J.H. (2016) Geologic map of Great Sand Dunes National Park, Colorado. U.S. Geological Survey Scientific Investigations Map 3362, 58 p., scale 1:35,000, <http://dx.doi.org/10.3133/sim3362>.

Nichols, H., Stolze, S. (2017) Modern pollen data from the Canadian Arctic, 1972–1973. *Scientific Data* 4:170065. DOI: 10.1038/sdata.2017.65.

Stolze, S., Monecke, T. (2017) Holocene history of ‘non-native’ trees in Ireland. *Review of Palaeobotany and Palynology*. DOI: 10.1016/j.revpalbo.2017.04.006.

Yao, Q., Liu, K.-b. (2017) Dynamics of marsh-mangrove ecotone since the mid-Holocene: A palynological study of mangrove encroachment and sea level rise in the Shark River Estuary, Florida. *PLoS ONE* 12(3): e0173670.

News from other Societies

The GSA Limnogeology Division

By Scott Starratt, U.S. Geological Survey, Menlo Park, CA



“It was a dark and stormy night”

Well, I don't really remember what the night was like back in 2002 when a group of GSA members with interests ranging from modern lake processes, microfossils, sedimentology, and lacustrine energy resources gathered to form the Limnogeology Division. The purpose of the division is four-fold. First, the division supports research of modern and ancient lake systems around the world; second, we encourage the collaboration of scientists from all disciplines studying lacustrine topics; third, we facilitate the presentation and publication of lake research; and fourth, we support students performing research on lakes or with an interest in careers in lacustrine studies. We do this mainly through our sponsorship of topical sessions and sectional and the annual meeting, the annual business and awards meeting, core workshops, field trips, and short courses. Members also serve on editorial boards of journals and books on lacustrine-oriented topics.

Awards

The division offers two awards. The **Israel C. Russell Award** is awarded for major achievements in limnogeology through contributions in research, teaching, and service. Past awardees have come from academia and industry, and their research has ranged from a detailed analysis of the Eocene Green River Formation to the Quaternary paleolimnology of African large lakes. The second award given by the division is in support of student research. The **Kerry Kelts Award** is a proposal-based award intended to assist graduate students in completing their thesis research.

Awardees over the past few years have studied the diatom record from an alpine lake in the northern

Sierra Nevada, California, ostracodes from the lower Colorado River, and the stratigraphic signature of large earthquakes.

Meetings

In addition to the topical sessions that the Limnogeology Division is sponsoring at the **GSA Annual Meeting October 22-25, 2017**, the division is organizing a short course entitled '**What's in my Lake**':

The changing Face of Limnogeology which will introduce many of the tools used by limnogeologists and best practices for using these tools in developing a research project. While anyone is welcome to attend, the short course is intended for graduate students and early career scientists.

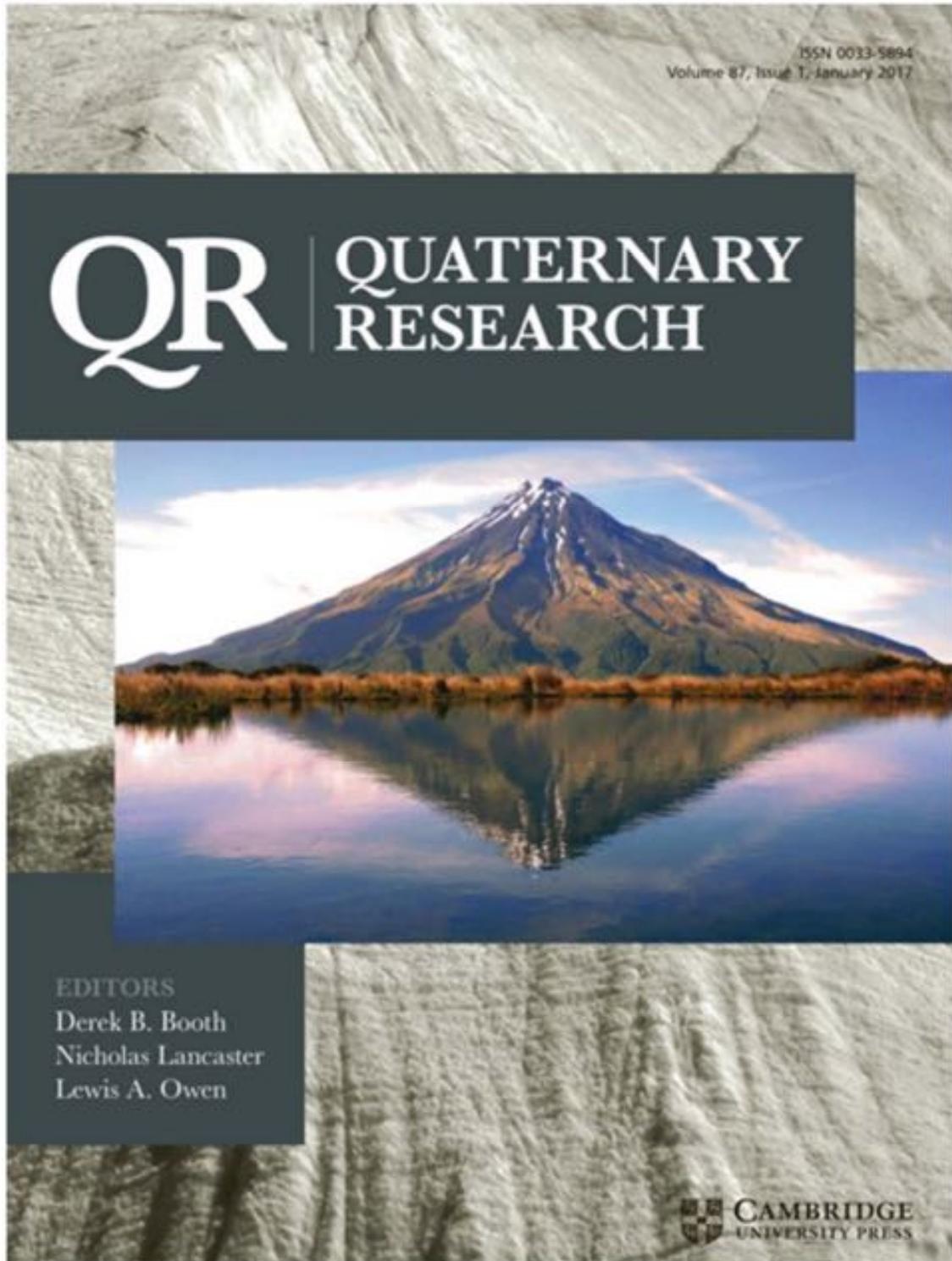
Further Information

Further information about the Limnogeology Division can be found on the division website <http://rock.geosociety.org/limno/index.html>

Journals and Newsletters

Successful transition of Quaternary Research to Cambridge University Press

By Derek Booth, Nick Lancaster, and Lewis Owen (Editors)



The Quaternary Research Center (QRC) of the University of Washington and AMQUA are very pleased to announce that as of January 1, 2017, Cambridge University Press is now publishing *Quaternary Research*. The transfer of publishers was extremely smooth and Issue 1 of Volume 87 was printed on schedule in mid-January. Issue 2 was ready for publication in early March and we are working on schedule to produce Issue 3 for early May.

Quaternary Research is published on behalf of the QRC and is the official AMQUA journal. The journal has a nearly 50-year, distinguished history of publishing articles of interdisciplinary interest on the evidence for Quaternary climatic and environmental changes, as well as their effects on landscapes, ecosystems, and human populations.

Many significant articles have been published in the journal over the years. As a result of these contributions of its many authors, *Quaternary Research* has established itself as a leading journal in its field, with a reputation for authoritative, high-quality papers of broad interdisciplinary interest. The journal's content is global in scope, as is its authorship, although North American researchers generally (and AMQUA members in particular) have always been core contributors. Over the past five years, research conducted in North America (USA, Canada, Greenland) comprises about one third (33.7%) of the published work. A further 23.5% was conducted in Asia (mainly China and Tibet), 18% was carried out in Europe (including Russia), and 12% in Latin America. About 3% of papers are global summaries or methods papers.

We encourage authors to continue to submit their best work to the journal. We have relaxed the former strict word limits on articles and review papers, and we also encourage authors to include their datasets as supplementary online material. Manuscripts that address human-environment interactions during the Quaternary, applications of Quaternary science to environmental management including geologic hazards, and new methods for investigation and analysis of Quaternary landforms and deposits are particular-

ly welcome. Review papers on important topics of broad interdisciplinary interest and proposals for topical special issues are also encouraged. The journal prides itself on thorough and rapid reviewing of manuscripts, with an average time for submission to publication online of ~ 3 months.

QRC will continue to partner with AMQUA to ensure that *Quaternary Research* remains available to AMQUA members at a reduced rate. We look forward to a new era for the journal in partnership with Cambridge University Press, in which it reaches new audiences while maintaining its reputation as a premier journal in Quaternary studies.

For direct access to the journal webpage go to:

<https://www.cambridge.org/core/journals/quaternary-research>

Sign up for content alerts (just click on the bell symbol on the top right of the journal home page) to stay current on the latest articles from *Quaternary Research*.

Follow the *Quaternary Research* blog at: <http://blog.journals.cambridge.org/2017/03/20/introducing-quaternary-research-an-interdisciplinary-journal/>

"Climate Matters" Newsletter

By Lesleigh Anderson, U.S. Geological Survey Denver, CO

The most recent newsletter "Climate Matters", a product of the USGS Climate and Land Use Change Research and Development Program is now available. Climate Matters is a quarterly newsletter with news and information about recent products and projects by USGS scientist. It can be accessed online: https://www2.usgs.gov/climate_landuse/clu_rd/newsletter.asp

Grant Opportunities

Larry D. Agenbroad Legacy Fund for Research – Grant Information 2017

By Justin Wilkins, The Mammoth Site of Hot Springs, SD, Inc.



Through the Legacy Fund, **The Mammoth Site** pays tribute to a man like no other. Dedication to life-long research and a passion for the education of young scientists were hallmarks of Dr. Agenbroad's 50 years career. Support contributed to this fund will ensure his legacy will continue long into the future.

The Legacy Fund provides support for proboscidean and Quaternary research from a world-wide approach. Funding assists scientists and students from the USA and abroad, in pursuit of meaningful, high-quality research. Project proposal may include topics ranging from arrival of mammoths in North America, proboscidean paleobiology and phylogeny, or topics otherwise related to understanding the Quaternary paleontological record.

Successful applicants will be expected to submit a nontechnical language summary of their study and results upon completion of their project. A public presentation and/or blog post for the website of The Mammoth Site about the research results is required. The intent of the requirements is to provide Mammoth Site visitors and members with scientific information from the leading edge of Quaternary research, and to promote public science education at The Mammoth Site – a non-profit research organization.

Grant applications will be accepted from all scientists or students conducting Quaternary research that meet the above guidelines. The deadline to submit proposals is February 1st of each year. Grants will be awarded in early May. Grant awards will be in amounts of \$1,000 or less.

Grant proposals must not be more than two (2) pages (12 point font, English language) and must include

the following information:

- Name of proposal principal investigator or lead co-PI.
- Email address of principal investigator or lead co-PI.
- Postal address to receive grant award if selected.
- Proposed project title.
- Project description. Your proposal will be considered by leading paleontologists so scientific jargon is accepted where appropriate. You must include: where the project is located, is there need for permission to conduct the project, and if so, do you have this permission at the time of proposal submission, what your project is, why it is important, and why do you need funds.
- Project timeline.
- Amount of funds being requested from the Larry D. Agenbroad Legacy Fund.
- Budget Explanation – A full project budget explanation is required. If your project requires more funding than available from the Legacy Fund, please explain how the requested funds will be complemented, and where additional funds are to come from.

Grant proposals are to be mailed to:

Dr. Jim I. Mead, Chief Scientist, The Mammoth Site:
at jmead@mammothsite.org. In the email heading indicate Legacy Proposal.

Must arrive at The Mammoth Site prior to May 1st.

USGS-NSF Graduate Research Intern Program (GRIP)

By Lesleigh Anderson, U.S. Geological Survey Denver, CO

Opportunities are now open with the USGS-NSF Graduate Research Intern Program (GRIP) which provides supplemental funding to participate in USGS research projects with USGS scientists. A new opportunity is now available titled "Holocene seasonal climatology in south-central Alaska from

intra-annual oxygen and carbon isotopes of fossil wood" with Lesleigh Anderson in Denver, CO. For a complete description of this and other opportunities visit: <https://powellcenter.usgs.gov/national-science-foundation-graduate-research-internship-program-grip>

Conference Announcements



AMQUA-Sponsored Sessions

T97. WILL MY BOAT FLOAT? — PHYSICAL AND BIOLOGICAL PROXIES FOR LAKE LEVEL VARIABILITY

CO-Conveners: Scott Starrat, USGS, Menlo Park, CA, sstarrat@usgs.gov

Sponsor(s): GSA Limnogeology Division; GSA Sedimentary Geology Division; American Quaternary Association (AMQUA); SEPM (Society for Sedimentary Geology); Paleontological Society.

Description: Lake level variability is a response to climate variability and human modification of the environment. This session seeks presentations that explore evidence for lake level change using a variety of physical and biological proxies.

T172. A CALL TO ARMS: APPLYING QUATERNARY SCIENCE IN THE 21ST CENTURY

CO-Conveners: Julio Betancourt, USGS, Reston, VA, jlbetanc@usgs.gov; Rolfe D. Mandel, University of Kansas & Kansas Geological Survey, Lawrence, KS, mandel@ku.edu

Sponsor(s): U.S. National Committee-International Quaternary Association (INQUA); American Quaternary Association (AMQUA); GSA Quaternary Geology and Geomorphology Division; GSA Geology & Society Division; GSA Soils IIG; GSA Environmental & Engineering Geology Division.

Confirmed Invited Speakers and Tentative Titles:

Lisa Ely, Central Washington University: “A continuing and evolving role for Quaternary Science in evaluating natural hazards during the 21st century”

Connie Woodhouse, University of Arizona: “Making the connection between Quaternary science and decision making”

Lynn Wingard, USGS-Reston: “Quaternary contributions to managing the Everglades, the largest ecosystem restoration project in the world”

Description: This session addresses how profound environmental, technological, and societal trends, and their interactions pose formidable consequences, requiring a repurposing and retooling of applied Quaternary science, with applications spanning disciplines, nations, and existing and emerging problems.

Rationale: For our GSA Session, we will aggressively pursue abstracts and speakers that we deem at the frontier of applied Quaternary science. The session is being proposed and sponsored by members of the U.S. National Committee-INQUA. Since its inception in 1928, one of INQUA's basic goals has been to improve communication and international collaboration in applied aspects of Quaternary research. This session is being proposed because many of the environmental and societal challenges in our fast-changing world will require a repurposing and retooling of Quaternary science to solve a daunting list of real-world problems. In July 2016, one of us (Betancourt) helped organized the very focused and popular 24th Biennial AMQUA meeting in Santa Fe with 26 plenary speakers and 84 lightning talks and posters around the theme “Retooling the Quaternary to Manage the Anthropocene” (<http://biology.unm.edu/fasmith/2016AMQUA/>).

Both AMQUA and the USNC-INQUA aim to continue building momentum towards a global “community of practice.” In that spirit, the USNC-INQUA and AMQUA will introduce a simple one-slide template for articulating grand challenges in “Applied Quaternary Science in the 21st Century”.

Presenters and participants in our session will be encouraged to prepare and submit Grand Challenge slides on the USNC-INQUA website. If this trial effort is successful and productive, we will promote the use of the template at subsequent GSA, AMQUA, INQUA, ESA, and AGU meetings and focused workshops. We hope that these USNC-INQUA slides can serve as inspiration and as an evolving resource for all of our professional society members in the U.S. and across the world.

Abstract deadline for all sessions is 11:59 p.m., Pacific Time, 1 August 2017.

Please submit abstracts at <http://community.geosociety.org/gsa2017/science-careers/sessions/topical>



THE
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**"Crossing borders
in the Quaternary"**



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Jules Blais
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Tom Lowell
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(Carleton University)
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(University of Ottawa)
(University of Ottawa)
(Carleton University)
(University of Cincinnati)
(Kansas State University)



Quaternary Research in Ireland and the Irish Quaternary Association (IQUA)

Ireland's famously beautiful landscape contains a wealth of evidence for a dynamic Quaternary history. With dramatic glacial landforms, varied coastlines, extensive peatlands, innumerable lakes, and a rich archaeological heritage, the island has long fascinated Quaternary scientists. Indeed, Ireland has a history of Quaternary research dating back to the nineteenth century, including famous visits by Agassiz in 1840 and Catvill Lewis in 1855, and its diverse Quaternary archives continue to provide fruitful avenues for research.

The Royal Irish Academy (RIA) Committee for Quaternary Research in Ireland was established in 1934, providing a key stimulus for the study of Ireland's Quaternary history. In the 1970s, the Irish Quaternary Association (IQUA) was founded with a view to co-ordinating and energising all aspects of Quaternary research in Ireland and passing on existing expertise through conferences and especially field excursions. Notable contributors over the lifetime of the Association include Frank Mitchell, Francis Sygne, Alan Smith, Bill Watts, Marshall McCabe and Willie Warren. The INQUA Congress held in Birmingham in 1977, which included excursions to Ireland led by Watts and Sygne, gave a further impetus to Quaternary studies in Ireland. Frank Mitchell, as President of INQUA for the intercongress period 1969-1973, and later through his classic book, *Reading the Irish Landscape*, also greatly helped in highlighting the multi-dimensional character of the Quaternary record in Ireland.

Currently, IQUA is a thriving organisation with well over 100 members, and disseminates information about its activities through its webpage (www.iqua.ie) and email list. The link between the RIA and INQUA continues to be positively fostered by active Quaternary scientists represented by the RIA's Geoscience Committee (formerly the National Committee for Geology), and by funding IQUA's national delegates to attend INQUA congresses. Furthermore, the recipient of IQUA's inaugural Frank Mitchell Award for Distinguished Service to Quaternary Research and Teaching, Pete Coxon, has served as both IQUA President (2008-2012) and as Secretary-General of INQUA (2003-2011), thus strengthening the link between IQUA and INQUA.

The following links will give you a sample of the Congress facilities and Ireland's Quaternary science community and landscape:

The Irish Quaternary Association (IQUA): <http://www.iqua.ie>

IQUA Field Excursions: <http://www.iqua.ie/publications.html>

The Convention Centre Dublin (the Congress Venue): <http://www.theccd.ie>

Wild Atlantic Way (Ireland's scenery): <http://www.wildatlantieway.com/home/>

Sign up for Congress Newsletters: www.inqua2019.org

Life on the Edge

**XX INQUA
Congress 2019**
25th – 31st July 2019
Dublin, Ireland



Details of the Pre-, Mid- and Post-Congress Field Trips are now available on the web: <http://www.inqua2019.org/field-trips/>. Full details and costs will be posted at the end of November this year.

The organizers invite preliminary suggestions for sessions (<http://www.inqua2019.org/programme-themes/>). Please contact the Chair of the Scientific Program, Keith Bennett.

www.inqua2019.org

